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THE ASSAY, CHARACTERISTICS, COMPOSITION,
AND ORIGIN OF OPIUM*

No. 16

A Study of the United Nations Samples of Opium

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In continuation of the international programme of scientific research undertaken pursuant to resolutions 159 II C (VII) and 246 F (IX), adopted by the Economic and Social Council on 3 August 1948 and 6 July 1949 respectively, the Secretary-General is presenting the following paper contributed by Dr. Panopoulos and Mr. Vassiliou, two Greek scientists who are collaborating in the programme. The paper continues the study of opium characteristics which may make it possible to determine the origin of opium seized from the illicit traffic, and includes discussion of the authors' theory of the origin of differing opium characteristics and the limitations upon origin determinations.

The authors develop the test of general appearance, describing various qualities of the opium that may be noted, and recommending the use of a magnifying glass and ultra-violet light to supplement the usual examination. They have also studied the quantity and appearance of the ash, and quantitative determinations of the various forms of nitrogen in the opium. They conclude that the characteristics studied give good indications of origin, but they do not regard the problem as solved by the studies made.

* Inclusion of an article by contributing scientists in this series does not necessarily mean that the Secretariat shares the views expressed.

A STUDY OF THE UNITED NATIONS SAMPLES OF OPIUM

By Dr. G. Panopoulos and Mr. A. Vassiliou

Purpose of the paper

1. The purpose of this paper is to present a study of the United Nations samples of opium. This study was made with the view of discovering characteristics that may be useful in the determination of origin.
2. The study covers observations on the appearance, both by the unaided eye and through a magnifying glass, and also the appearance under ultra-violet light; the colour of the ash, both by natural light and under ultra-violet light; and quantitative determination of the ash and of the several forms of nitrogen in the opium.

Discussion

3. Defining the characteristics of opium which show its origin in a particular country is a difficult problem, as the physical properties and chemical constituents and the relations between them are dependent on many factors.
4. The method of cultivating the plant, the general weather conditions, how the opium is collected, the way the lumps of opium are packed and stored, are among the factors which determine the characteristics of the particular opium.
5. It may be possible that these conditions so affect the opium produced that even seeds from plants yielding a known type will produce a different type of opium and so it might be impossible to say that opium of a particular region has certain definite ratios between its constituents.
6. It is also to be noted that the distinction according to country is primarily political, though perhaps finally ethnological or geographical; but the factors causing the production of different types of opium are geological, climatic, and technical.
7. Thus it is natural that the plants cultivated in two different continents, but under the same climatic and geological conditions, should have the same percentage composition of the opium, if the technical conditions remain the same. Doubtless it would be rare, though not impossible, to find so many factors agreeing. Therefore, it is natural for the products to differ; but again such

differences vary between maxima and minima, and in different regions the variations will overlap, so that they cannot be completely separated according to countries or ethnological and geographical regions.

8. These results are noted in the products of one country if the technical conditions of cultivation, collection, and storage differ. So the products of Turkey not only present differences when they come from different districts but also products of the same district may sometimes show a different proportion in some of the relationships between constituents.

9. On this basis it is not possible to define the characteristics showing the origin of the opium by merely examining one sample from a district for the percentages of its constituents and the relations between them. It is a matter of examining numerous samples from a series of harvests. Then from the statistics we would draw conclusions by which we could probably distinguish the groups from different districts. Such distinctions could be made so probable that they would be but little short of certainty.

10. We wish to emphasize that the observation of characteristics of an annual harvest may make it possible to recognize opium from this harvest, but we consider that it would be unsafe to conclude that later harvests would necessarily have the same characteristics.

11. We have received the following samples of opium from the Opium Distribution Centre of the United Nations:

1 sample	originating from	China
3 samples	"	India
3 samples	"	Indochina
2 samples	"	Korea
15 samples	"	Turkey
<u>2 samples</u>	"	Yugoslavia

Total: 26 samples

12. In the tables below the characteristics of these samples are compared.

TABLE I

Serial No.	Details of the origin of samples	Colour	Appearance through a magnifying glass	Appearance of the fragment	Fragile or not	Remarks
TURKEY, Nos. 1 to 15						
1	AYDIN No. 1 (C)	Dark brown	Many light brown spots	Vitreous	Almost unbreakable	Has residue of leaves; pressed it sticks to fingers.
2	AFYON No. 2 (B)	"	Light brown pockets with white spots	Granular	Fragile	" "
3	ÇORUM No. 3 (B)	Brownish red	Small metallic coloured spots as well as light brownish red pockets	Vitreous	Vitreous compact	" "
4	CAL No. 4 (B)	Dark brown	Granular with light brownish red spots and mould	Granular	Fragile	" "
5	USAK No. 5 (B)	Dark brownish red	Finely grained with lighter coloured spots and with white grooves	Finely grained	Fragile	" "
6	NALLIHAN No. 6 (B)	Dark brown with lighter coloured grooves	Uneven surface with different coloured spots to semi-white	Granular dull surface	Fragile	" "
7	MERZIFON No. 7 (C)	Dark brown	Small spots of a lighter colour	Granular with small pockets	Fragile	" "
8	BURDUR No. 8 (B)	"	Small spots of a lighter colour with many white grooves (mould)	Uneven with white leavings	Fragile	" "
9	KULA No. 9 (B)	"	"	Uneven	Fragile with grain	" "
10	SANDIHLI No. 10 (B)	Dark brown	Many spots of a lighter colour with many white grooves (mould)	Uneven	Fragile with grain	It has residue of leaves; pressed does not stick to fingers
11	AKSEHIR No. 11 (B)	"	Uneven surface with metallic shine in parts	Uneven	Fragile	" "

Serial No.	Details of the origin of samples	Colour	Appearance through a magnifying glass	Appearance of the fragment	Fragile or not	Remarks
12	ZILE No. 12 (C)	Dark brown	Granular spots of a lighter colour with empty apertures	Granular	Fragile	It has residues of leaves; pressed does not stick to the fingers
13	ISPARTA No.13 (B)	"	Spots of a lighter colour and white spots	Uneven granular	Fragile	" "
14	MAIATYA No.14 (C)	Brownish red	Spots of a lighter colour with red grooves	Glossy	Fragile	It has residues of leaves; pressed sticks to fingers
15	EXPORTATION No.15	Dark brown	Spots of a lighter colour with white lines (mould)	Granular	Fragile	It has residue of leaves; pressed does not stick to the fingers
16	INDIA, BANARAS No.1	Black	Waxy surface	Well-shaped like wax	Fragile like putty	Pressed sticks to the fingers; greasy in touch
17	INDIA, MAIWA No.2	Brownish black	Smooth, even surface	Even, dull surface like Spanish wax	Fragile tough in all directions	It has residues of leaves; sticks lightly to the fingers; greasy to touch
18	INDIA, EXCISE No.3	Dark brownish black	" " "	" "	"	Greasy to touch
19	KOREA No. 1	Brownish black	Brownish black, even, dull surface	Vitreous	Fragile	No residue of leaves; pressed does not stick to the fingers
20	KOREA No. 2	Brownish black	Spots of a lighter brown colour; even surface	Like a fragment of Spanish wax	Tough	Greasy to touch
21	YUGOSLAVIA No.1	Dark brown	Smooth surface with spots of a lighter colour	Even (dull) surface like Spanish wax	Fragile	It has residues of leaves; pressed does not stick

Serial No.	Details of the origin of samples	Colour	Appearance through a magnifying glass	Appearance of the fragment	Fragile or not	Remarks
22	YUGOSLAVIA No.2	Dark brown and lighter in parts	Dark brown; lighter in parts	Uneven, granular	Fragile	It has residues of leaves; pressed does not stick
23	INDOCHINA LUANG-PHABANG (A)	Brownish red	Granular with spots of a lighter colour to brownish red	Granular	Very fragile and friable	Has pieces of white wrapping paper
24	INDOCHINA XIENG-KHOUANG (B)	Dark brownish black	Very glossy surface with spots of a lighter colour as well as apertures of different sizes	Dull surface like Spanish wax		Has residues of leaves; pressed sticks lightly
25	INDOCHINA LACKAY	"	"	"	"	"
26	CHINA (B)	Dark brown	Smooth and even surface	"	Fragile	It has not residue of leaves; pressed does not stick
27	GREECE THRACI (1)	Dark brown	Uneven surface and of a lighter colour in parts	Uneven granular	Fragile	It has residues of leaves; pressed does not stick to fingers
28	GREECE THRACI (2)	"	"	"	"	"

13. From the data in Table I, it is concluded that the samples of opium show considerable characteristic distinction in groups. Thus the group of samples from India show, besides the brownish black colour, a very glossy surface, and a broken fragment has an even surface, lusterless like Spanish wax, without little pockets, and greasy to the touch.
14. The samples from Korea, Indochina, and China have a somewhat similar appearance, in distinction from all the more numerous samples from Turkey, Yugoslavia and Greece.
15. The samples from Yugoslavia and Greece are alike in appearance.
16. In Table II we give the appearance of the ash of the samples, under natural light and also as seen by the reflection of ultra-violet light. The colour of the ash in the two cases may indicate some characteristic related to origin.
17. The colour of the ash of sample 26 (China B), which under natural light is in various shades from light pink to brick colour, seems to be characteristic for this type of opium.
18. One of the means of distinguishing types of opium was thought to be the relationship between the total water-soluble nitrogen and the amount of nitrogen in the morphine.
19. For determination of the total water-soluble nitrogen the following method was used:

Four grammes of well-ground opium, dried at 60-70° C, are taken, and put in a mortar with 4 cc water and rubbed to a homogeneous mixture. After rubbing for 10 minutes the mixture is rinsed into a pyrex beaker with 40 cc water. After standing for an hour, with frequent stirring with a glass rod, the solution is filtered into a volumetric vessel of 100 cc. The glass and the filter paper are washed and the volume made up to 100 cc with distilled water. 10 cc of this solution is put in a Kjeldahl flask, with 25 cc of concentrated sulfuric acid, 10 grammes of potassium sulfate, and 1 gramme of copper sulfate. This is left for half an hour. It is then heated for half an hour by a small flame, and afterward the nitrogen is determined in the usual way.
20. The following process was used to determine volatile or ammoniacal nitrogen (all the volatile basic compounds determined by this process are calculated as ammoniacal nitrogen):

Table II

Serial No.	No. of origin of samples	Appearance of Ash	
		Natural light	Reflection of Ultra-Violet
1.	TURKEY, Nos 1 to 15	Greyish colour	Brownish red; violet in parts
2.	AYDIN No. 1 (C)	Greyish colour;	Brown; violet in parts
	AFYON No. 2 (B)	yellowish in parts	
3.	ÇORUM No. 3 (B)	Whitish; light pink in parts	Brownish black
4.	ÇAL No. 4 (B)	Greyish colour;	Light brownish red, with some spots bright orange-reddish
		yellowish in parts	
5.	USAK No. 5 (B)	Greyish	Brownish black
6.	NALLIHAN No.6 (B)	Semi-white; greyish in parts	Brown; violet in parts
7.	MERZIFON No.7 (C)	White	Violet
8.	BURDUR No. 8 (B)	Semi-white; yellowish in parts	Light brownish red; violet in parts
9.	KULA No. 9 (B)	Semi-white; yellowish in parts	Greyish; with some bright orange-red spots
10.	SANDIQLI No.10 (B)	Greyish; in parts yellowish	Brownish black
11.	AKSEHIR No.11 (B)	Orange-yellowish	Orange-yellowish
12.	ZILE No. 12 (C)	White	Violet with many bright orange-reddish spots
13.	ISPARTA No.13 (B)	Semi-white; light grey in parts	Brownish black
14.	MALATYA No.14 (C)	White	Violet with many white spots of reddish orange colour
15.	EXPORTATION No.15	Grey colour; orange-reddish in parts	Brownish black; grey in parts
16.	INDIA, BANARES	Orange (light)	Brownish black
17.	INDIA, MALWA	White	Violet with some bright orange-reddish spots and a few light blue
18.	INDIA, EXCISE	White	Dark violet with some bright orange-reddish spots
19.	KOREA No. 1	Light grey; pinkish red in parts	Dark violet
20.	KOREA No. 2	Grey	Dark violet
21.	YUGOSLAVIA No. 1	White	Dark violet
22.	YUGOSLAVIA No. 2	Light pink; white in parts	Dark violet
23.	INDOCHINA LUANG PRABANG (A)	White	Dark violet
24.	INDOCHINA XIENG KHOUANG	White	Dark violet with a few bright orange-reddish spots
25.	INDOCHINA LAOKAY	Very light yellowish-red	" " "
26.	CHINA (B)	Light pinkish brick	Dark violet
27.	GREECE, THERACE No. 1	Light greyish	Dark violet
28.	THERACE No. 2	Light greyish	Dark violet

50 cc of the solution of water-soluble compounds is put in an apparatus for distilling off ammonia (in the usual determination of nitrogen), and 5 cc of a 30% solution of NaOH is added. The distillate is caught in a flask containing a measured volume of a normal solution of acid. After the distillation the excess of acid is titrated, with methyl orange as indicator.

21. The difference in percentage between the total water-soluble nitrogen and the ammoniacal nitrogen is the non-volatile water-soluble nitrogen.
22. The relationship of the non-volatile nitrogen to the nitrogen of the morphine content gives some characteristic indications of origin.
23. The results of the nitrogen determinations mentioned are given in Table III. Also the percentage of ash for the samples dried at 60-70° C, and its relationship to the non-volatile water-soluble nitrogen, are included in this Table.
24. Two charts are attached, which show graphically the relationship between the nitrogen of the morphine and the total non-volatile water-soluble nitrogen. Chart 1 shows the relationship for all the samples separately and Chart 2 shows it for the average of the samples from each country.
25. From Chart 1 it is evident that these relationships might be used as an indication of origin. For example, Nos. 19 and 20, the samples from Korea, are easily distinguished from the others. No. 26 from China, and Nos. 23 and 24 from Indochina, can also be distinguished.
26. Photographs of characteristic broken surfaces of some of the samples are also attached. In these photographs the uneven and granular surface of the Turkish samples may be contrasted with the smooth dull surface of the samples from India, Indochina, and China. Coloured photographs would of course show the characteristic differences much more clearly than is possible in black and white.

Conclusions

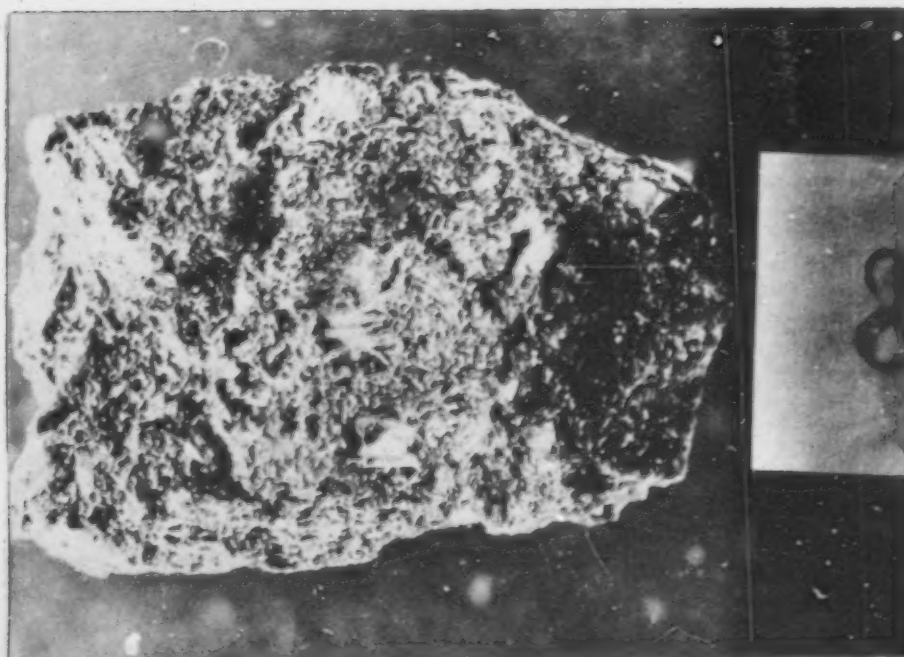
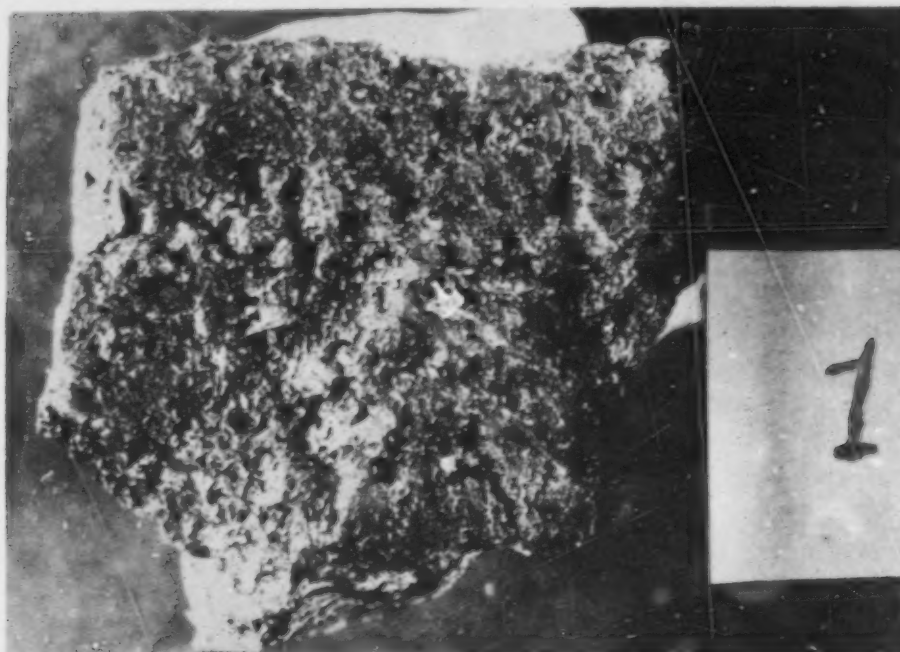
27. A detailed examination of the sample, including observation under a hand lens and under ultra-violet, will reveal good indications of its origin.
28. The amount of ash, its colour under natural light and under ultra-violet, will add new characteristic elements which are important in some cases.

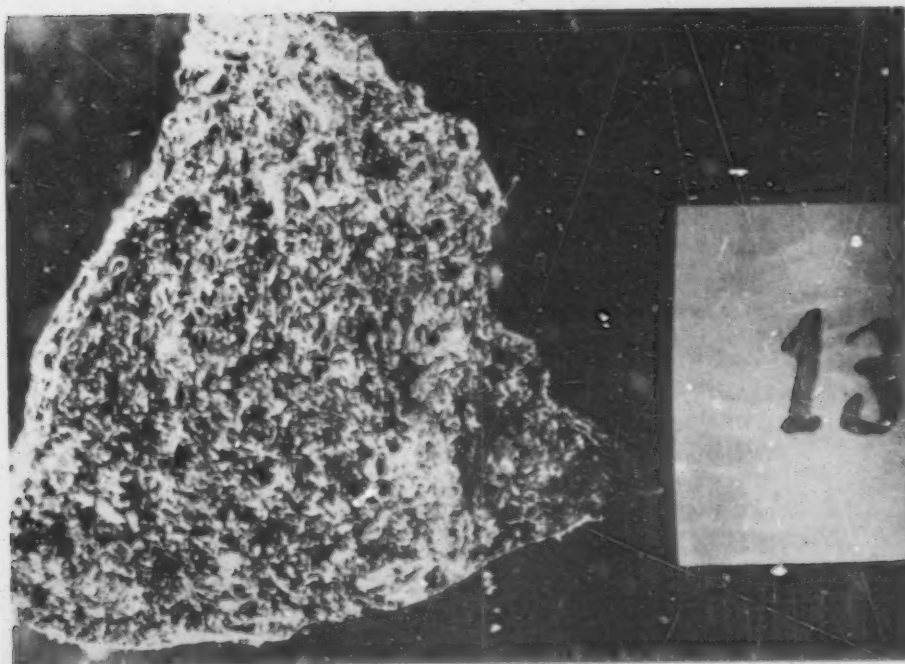
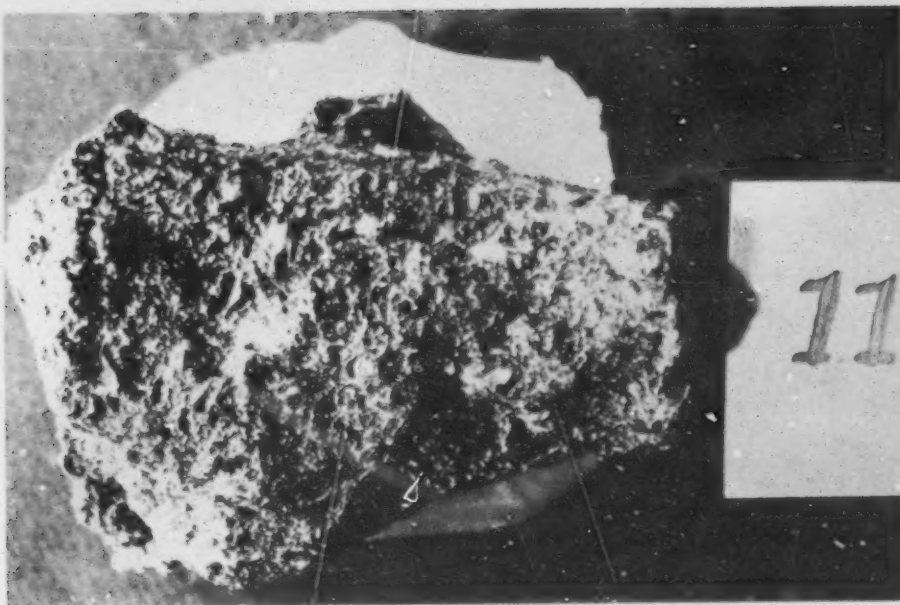
TABLE III

Serial No.	Country	Ash	Nitrogen of morphine	Total water-soluble nitrogen	Ammoniacal nitrogen	Non-volatile water-soluble nitrogen	Relationship of non-volatile water-soluble nitrogen to the nitrogen of morphine	Relationship of non-volatile water-soluble nitrogen to the amount of ash
1.	TURKEY	3.28	0.716	2.5025	0.273	2.2295	3.110	1.47
2.	"	5.81	0.687	1.82	0.210	1.610	2.343	3.60
3.	"	3.00	0.909	2.66	0.293	2.387	2.626	1.25
4.	"	3.71	0.7385	2.205	0.182	2.023	2.737	1.35
5.	"	3.51	0.800	1.680	0.189	1.491	1.864	2.35
6.	"	5.37	0.597	1.855	0.245	1.610	2.690	3.33
7.	"	2.37	0.870	2.100	0.210	1.890	2.171	1.25
8.	"	4.57	0.6855	1.645	0.196	1.449	2.110	3.14
9.	"	4.37	0.795	1.995	0.217	1.778	2.236	2.46
10.	"	5.34	0.613	1.750	0.196	1.554	2.535	3.43
11.	"	5.88	0.550	1.715	0.196	1.519	2.762	3.86
12.	"	3.72	0.4981	2.415	0.231	2.184	4.390	1.70
13.	"	4.61	0.5074	1.925	0.203	1.722	3.390	2.67
14.	"	3.52	0.5963	2.275	0.245	2.030	3.440	1.73
15.	"	6.84	0.6605	1.96	0.203	1.757	2.660	3.88
16.	INDIA	3.88	0.4901	2.485	0.308	2.177	4.44	1.78
17.	"	3.50	0.515	2.310	0.322	1.980	3.92	1.77
18.	"	3.63	0.426	2.625	0.238	2.387	5.60	1.52
19.	KOREA	6.87	0.247	6.100	1.370	4.730	19.17	1.45
20.	"	12.40	0.2267	4.620	0.945	3.675	16.21	3.37
21.	YUGOSLAVIA	3.95	0.795	2.520	0.231	2.289	2.88	1.72
22.	"	4.15	0.736	2.030	0.266	1.764	2.40	2.35
23.	"	2.13	0.643	2.590	0.273	2.317	3.60	0.91
24.	INDOCHINA	2.12	0.520	2.765	0.378	2.387	4.600	0.92
25.	"	3.29	0.7017	2.345	0.283	2.062	2.935	1.58
26.	CHINA	9.82	0.3974	2.625	0.807	1.818	4.550	5.40
27.	"	2.690	0.8833	2.700	0.259	2.441	2.763	1.10
28.	GREECE	3.070	0.7935	2.654	0.247	2.407	3.033	1.27

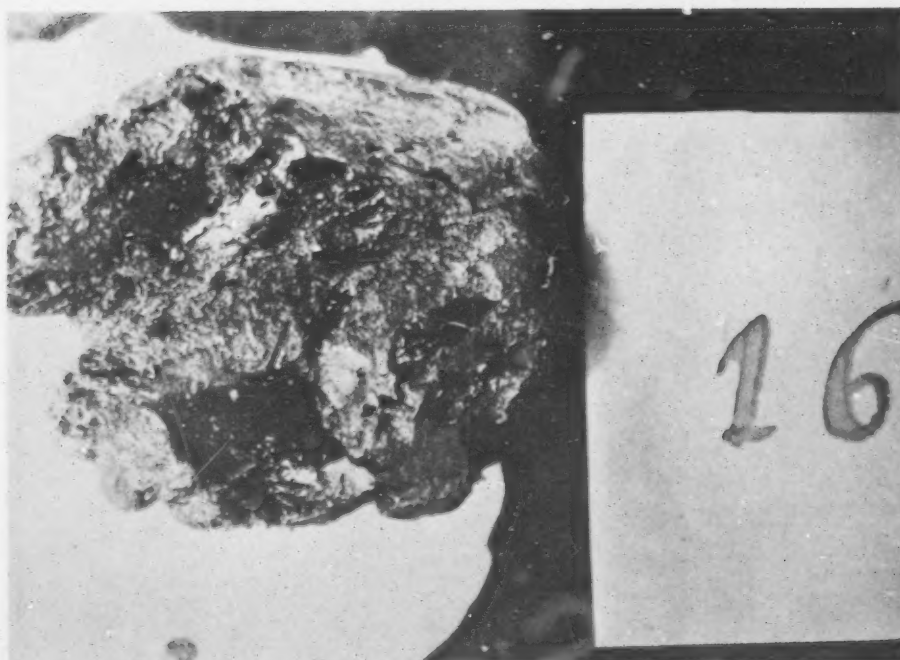
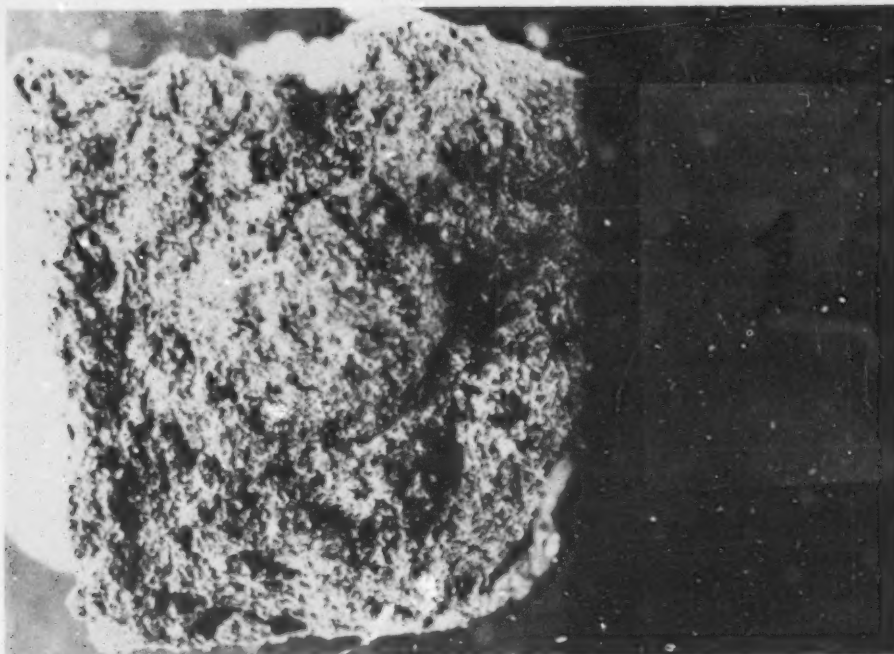
29. The amount of morphine or of its nitrogen, and the comparison of that quantity to the total non-volatile nitrogen, add new elements which characterize the opium.
30. With all the things mentioned we do not consider the problem of determining the origin of opium as solved, but that other elements added to those described will combine to yield the safest possible determinations.
31. Research on other aspects of the same problem will be continued by us, and also studies in the determination of morphine in opium.

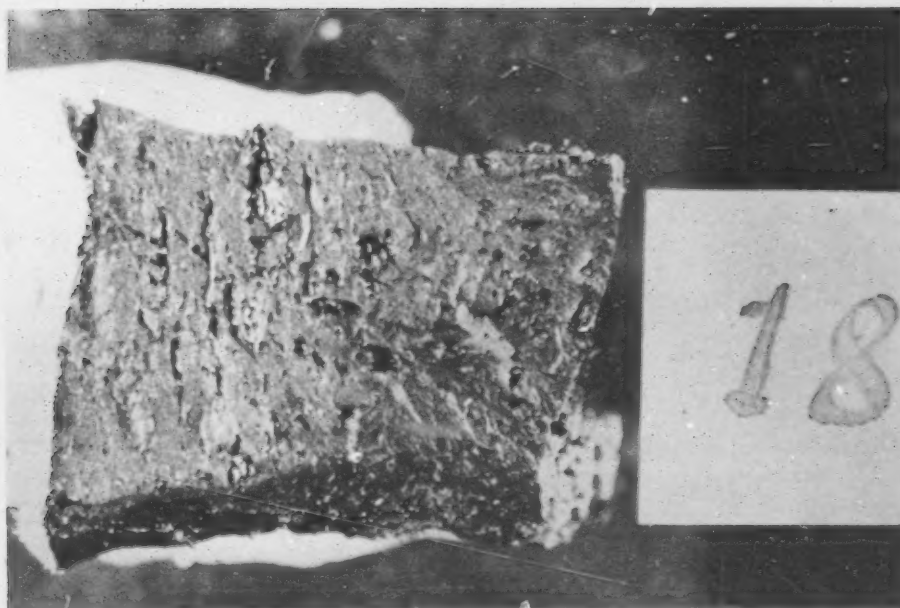
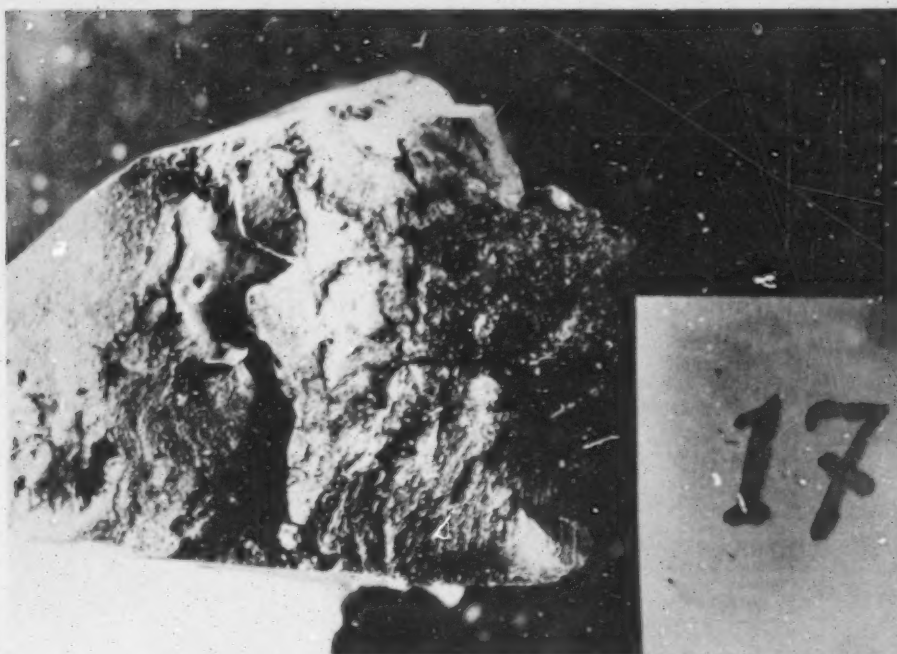
PHOTOGRAPHS OF FRAGMENTS OF OPIUM SAMPLES (identified by number)
showing the characteristic differences in the broken surfaces.





ST/50A/SER.K/16
English
Page 14





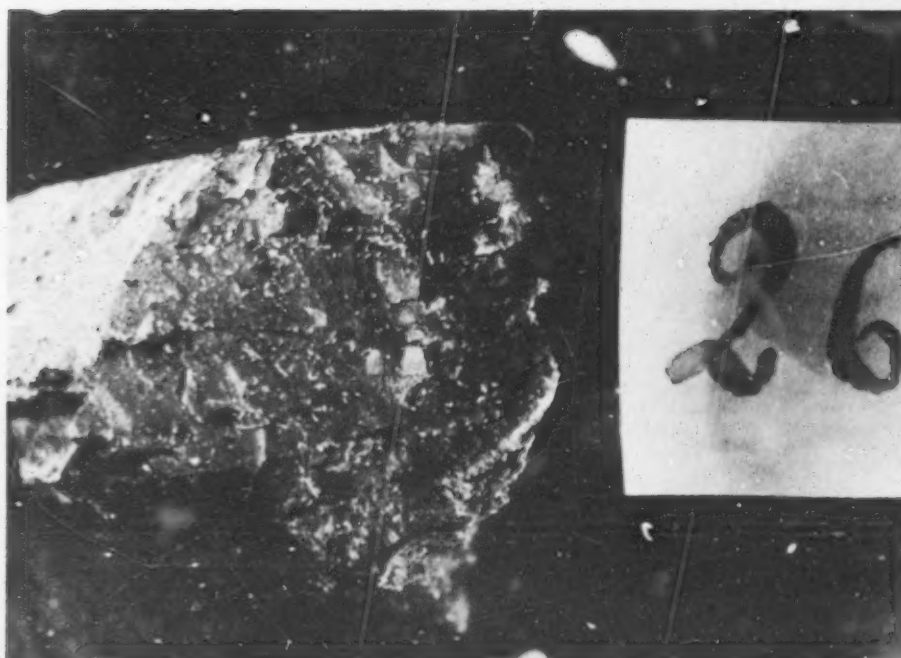
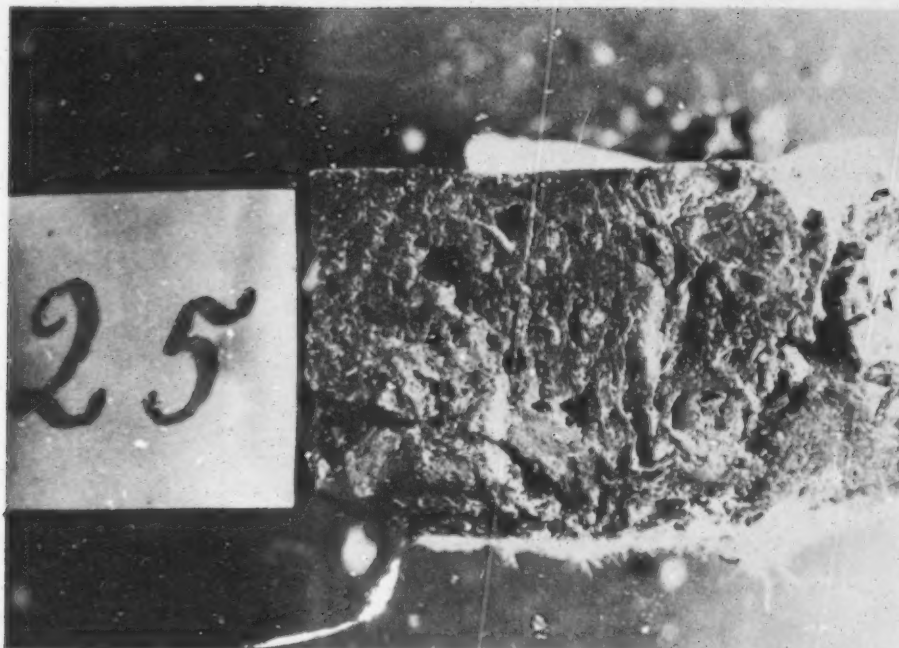


CHART 1. Relation of the nitrogen of the morphine to the total non-volatile water-soluble nitrogen for each of the opium samples examined.

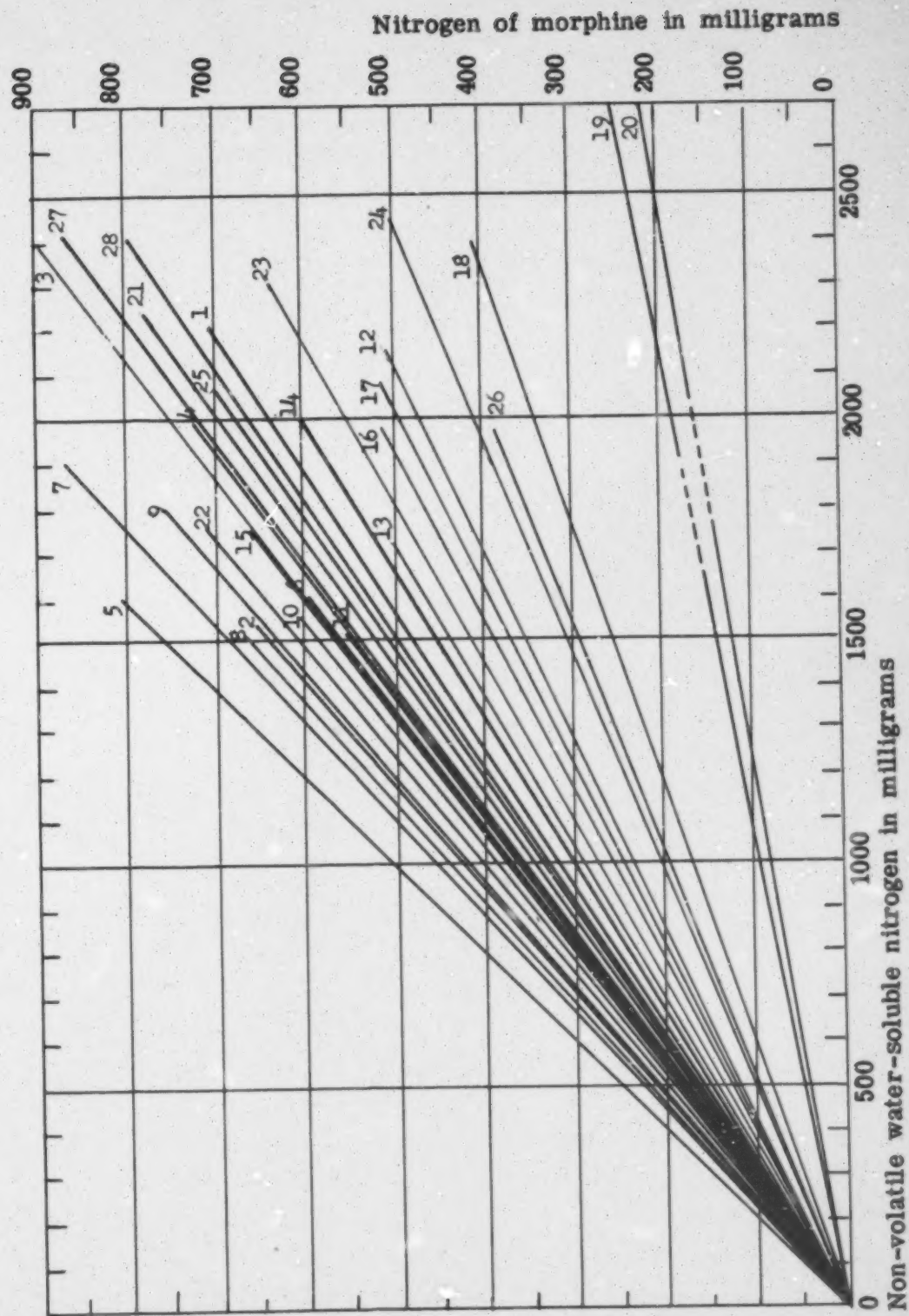


CHART 2. Average relation, for the samples from each country separately, of the nitrogen of the morphine to the total non-volatile water-soluble nitrogen of the opium.

